



Benchmarking energy scenarios for China: perspectives from top-down, economic and bottom-up, technical modelling

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Benchmarking energy scenarios for China: perspectives from top-down, economic and bottom-up, technical modelling

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Hancheng Dai

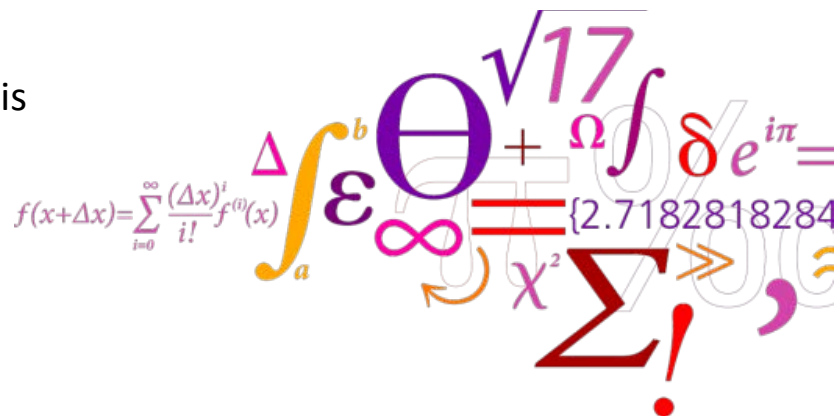
The National Institute for Environmental Studies, Japan

Xuxuan Xie

Energy Research Institute, National Development and Reform Commission, P.R. China

Toshihiko Masui

The National Institute for Environmental Studies, Japan



Abstract

- This study uses a **soft-linking methodology to harmonise two complex global top-down and bottom-up models with a regional China focus**. The baseline follows the GDP and demographic trends of the Shared Socio-economic Pathways (SSP2) scenario, down-scaled for China, while the carbon tax scenario follows the pathway of the Asia Modelling Exercise.
- We find that **soft-linking allows "bridging the gap" and reducing uncertainty between these models**. Without soft-linking, baseline result ranges for China in 2050 are 240-260 EJ in primary energy, 180-200 EJ in final energy, 8-10 GWh in electricity production and 15-18 Gt in carbon dioxide emissions.
- The **highest uncertainty in modelling results can be mapped for China's future coal use** in 2050, in particular in electricity production.
- **Sub-regional China features, when incorporated into complex global models, do not increase uncertainty in China-specific modelling results further**. These new sub-regional China features can now be used for a more detailed analysis of China's regional developments in a global context.

知之为知之，不知为不知， 是知也

If you know, recognize that you know,
If you don't know, then realize that you don't know:
That is knowledge.

Confusius

Highlights

To the best of our knowledge, this study is...

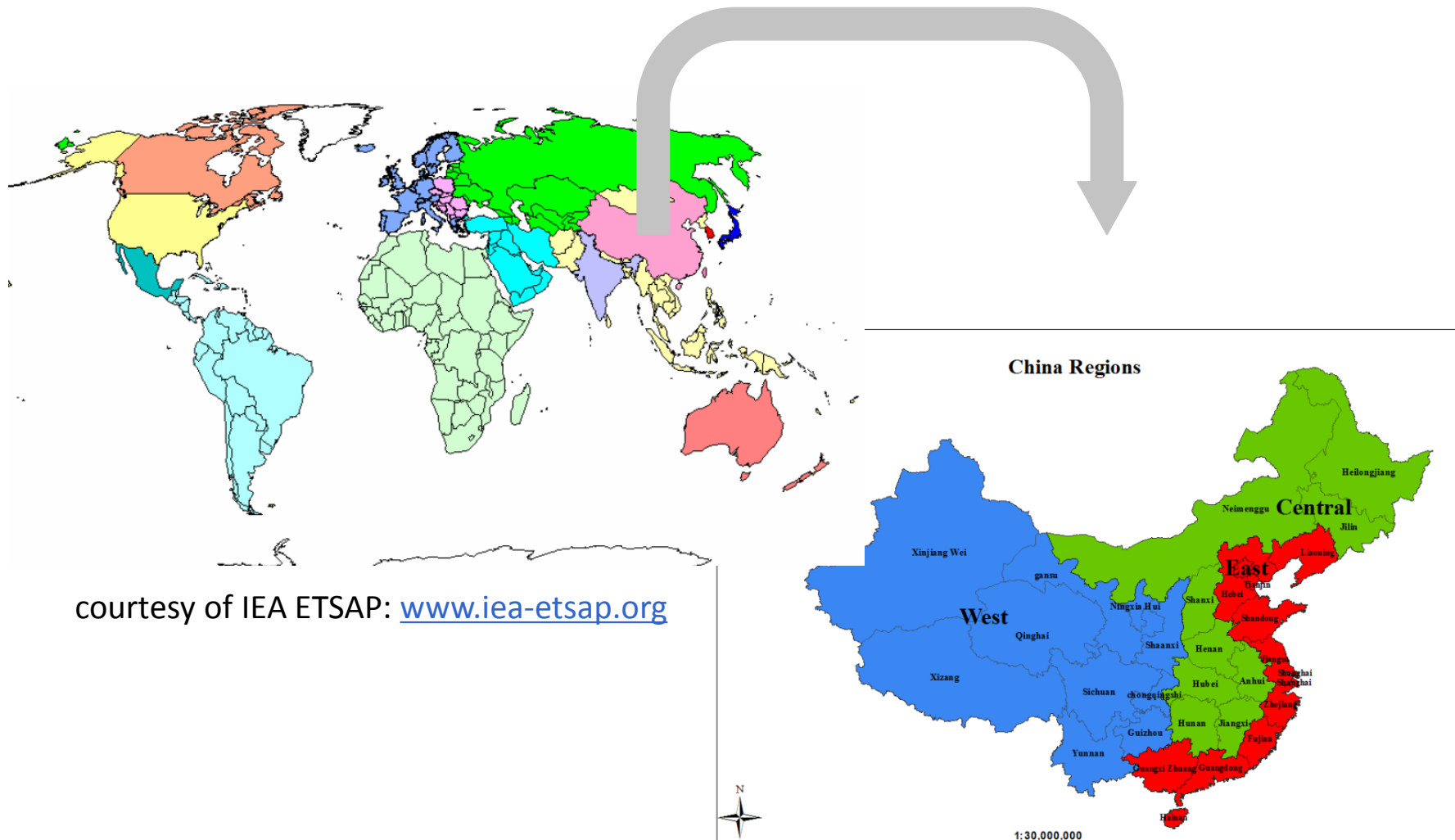
- the 1st global model comparison with **harmonised socio-economic assumptions for China, using a moderate IPCC Shared Socio-Economic Pathway Scenario (SSP2)**.
- the 1st soft-linking study that **down-scales global energy scenarios for three regions of China**.

Key results of this study are benchmarked with global and China specific results derived from 23 global models from the 2012 **Asia Modelling Exercise**. A **highly transparent, interdisciplinary and open-data approach** is applied to cope with uncertainty.

Calvin, K., L. Clarke, V. Krey, G. Blanford, K. Jiang, M. Kainuma, E. Kriegler, G. Luderer and P. R. Shukla (2012). "The role of Asia in mitigating climate change: results from the Asia modeling exercise." *Energy Economics* **34**: S251-S260

O'Neill, B. C., E. Kriegler, K. Riahi, K. L. Ebi, S. Hallegatte, T. R. Carter, R. Mathur and D. P. van Vuuren (2013). "A new scenario framework for climate change research: the concept of shared socioeconomic pathways." *Climatic Change*: 1-14

Global and China-specific insights

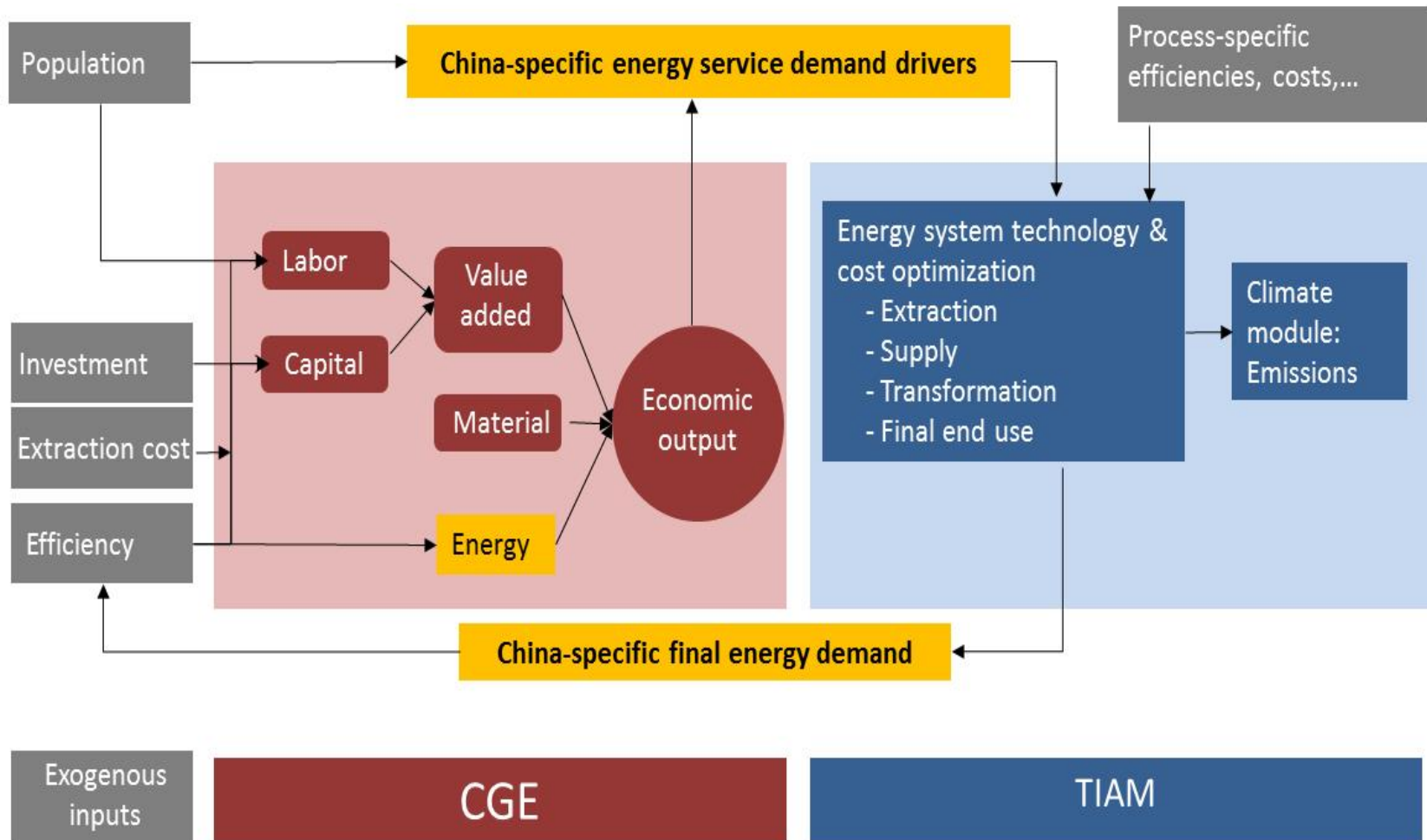


社 会主义和市场经济之间不存在根本矛盾

Socialism and market economy are not incompatible.

Deng Xiaoping

Top Down - Bottom Up - Model Linking Framework



我坚信，

**到中国共产党成立100年时全面建成小康社会的目标一定能实现，
到新中国成立100年时建成富强民主文明和谐的社会主义现代化国家的目标一定能实现，**

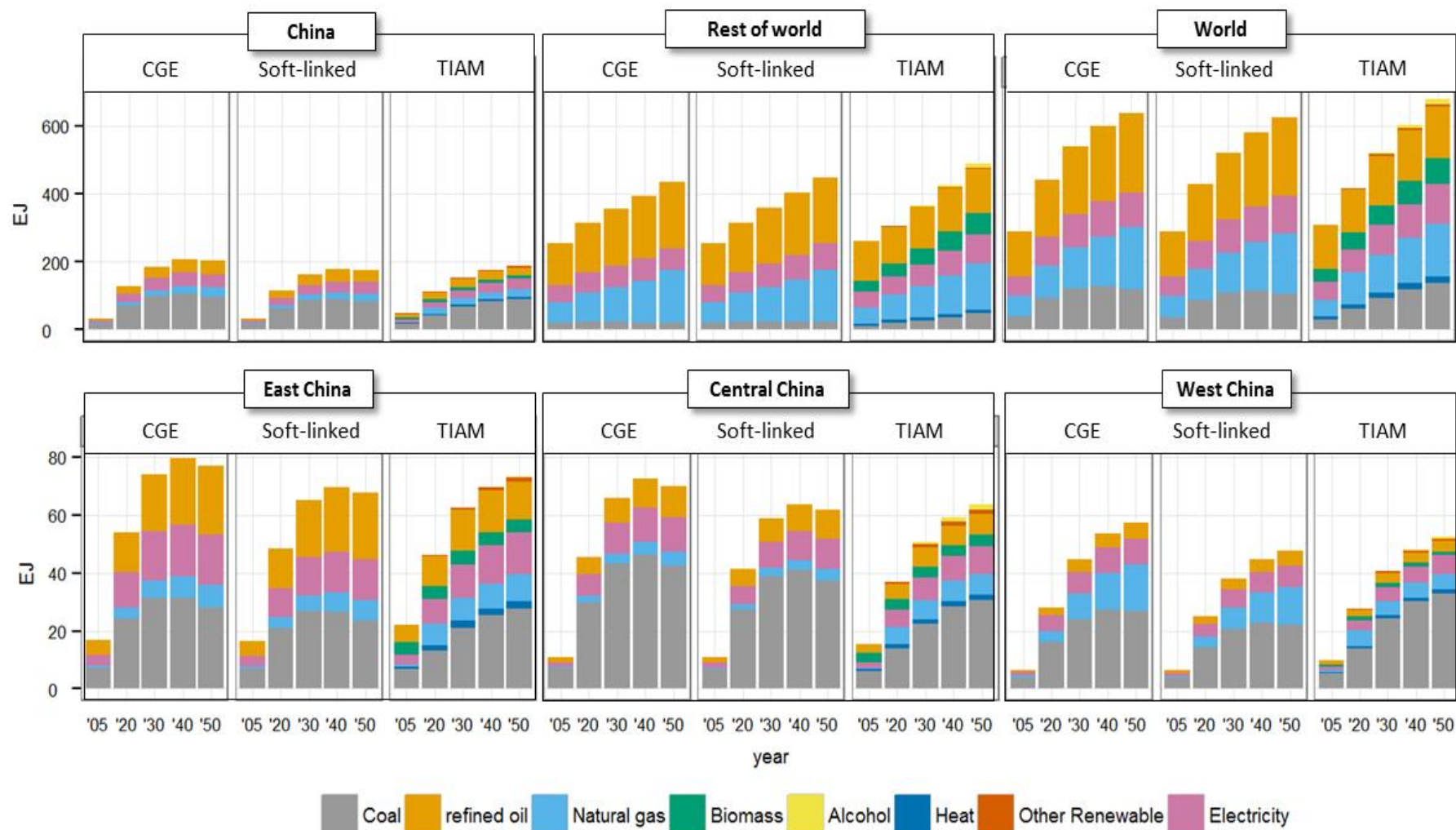
中华民族伟大复兴的梦想一定能实现

Achieving the “Two 100s”:

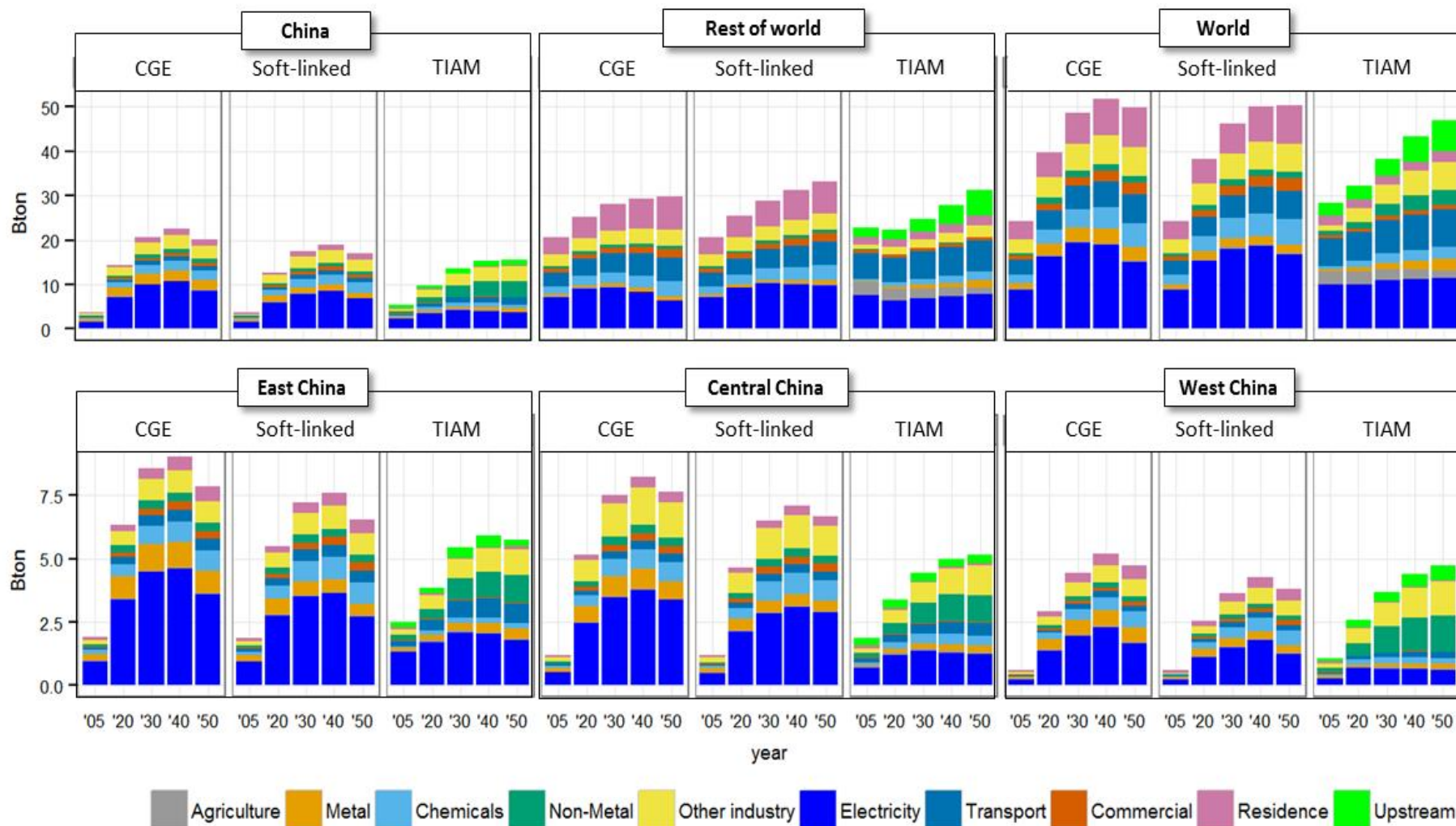
**the material goal of China becoming a “moderately well-off society” by about 2020,
the 100th anniversary of the Chinese Communist Party,
and the modernization goal of China becoming a fully developed nation by about
2049, the 100th anniversary of the People’s Republic.**

Xi Jinping

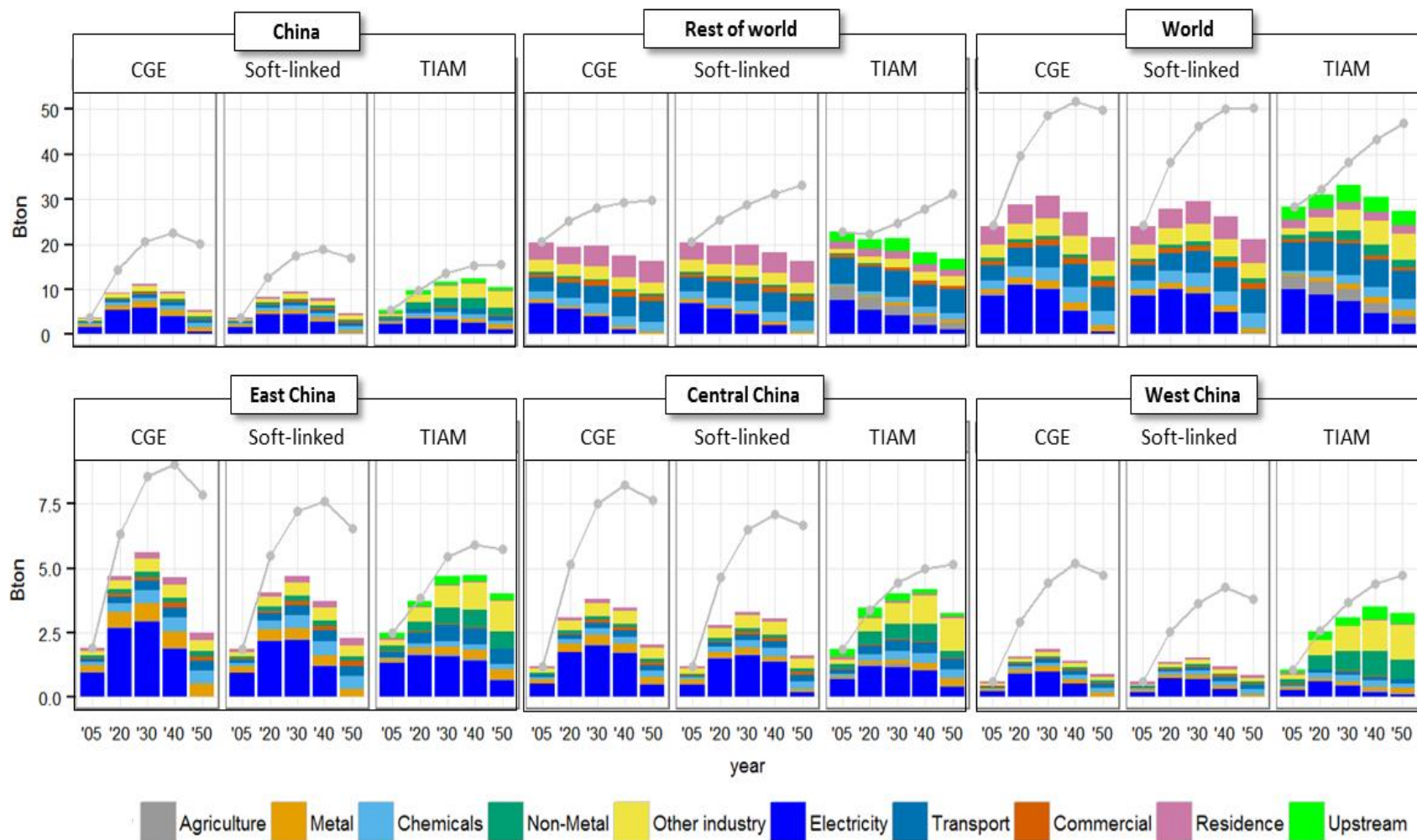
Final energy use – SSP2 harmonised baselines, down-scaled for China



CO₂ emissions – SSP2 harmonised baselines, down-scaled for China



CO₂ emissions under a carbon tax– Replication of AME tax pathway towards 2050



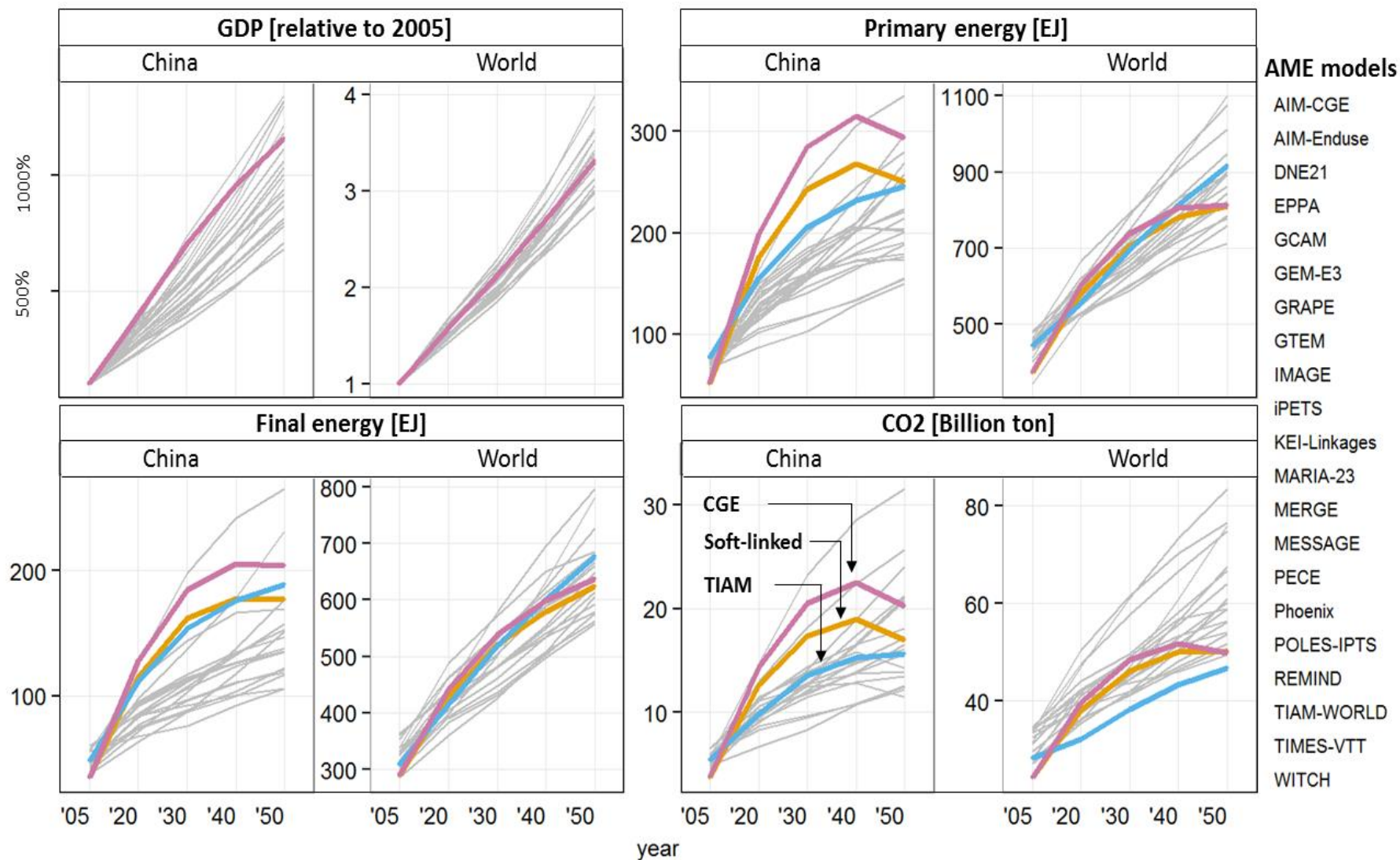
实事求是

Seek Truth from Facts.

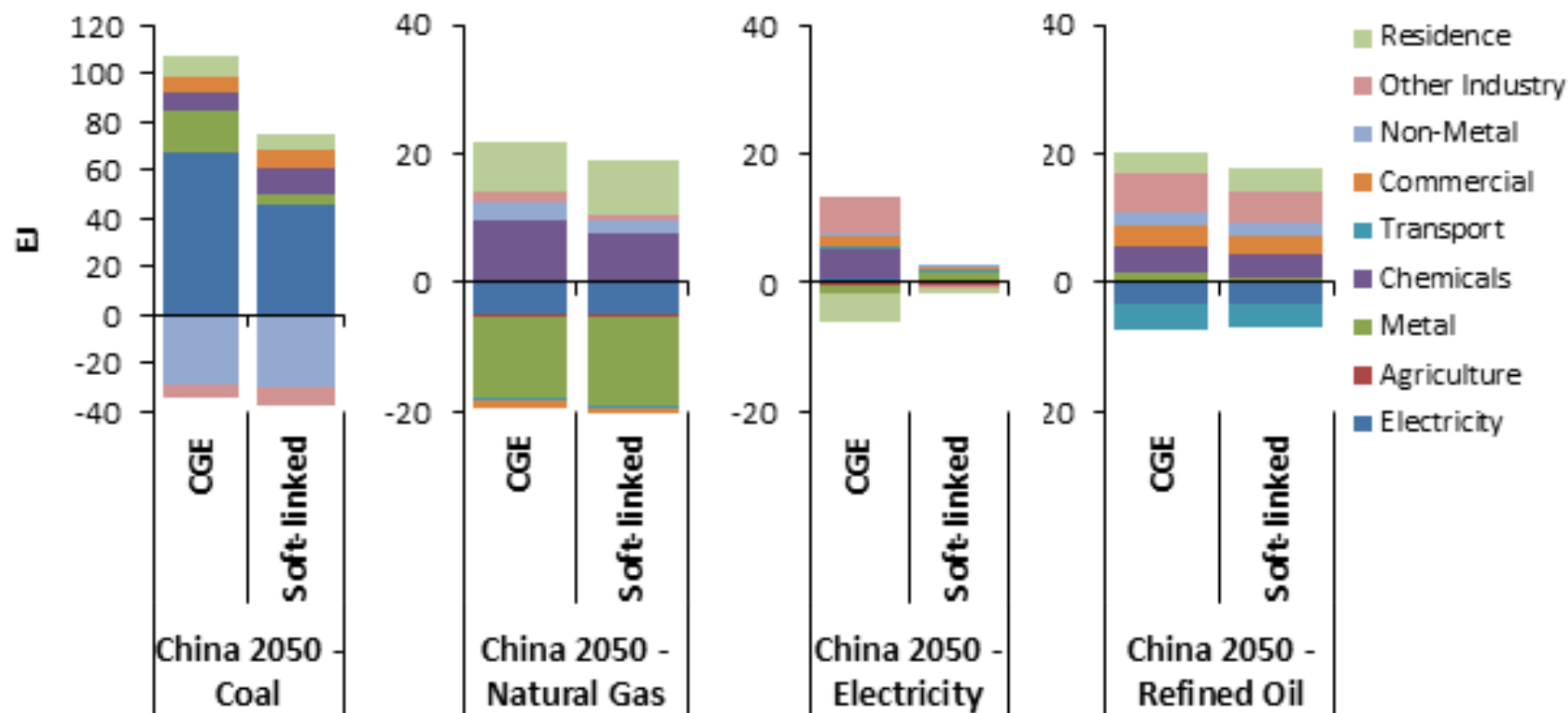
Han Shu,

later used by Deng Xiaoping and Mao Zedong

Benchmarking and AME model comparison – baseline



Exploring uncertainty in China's energy use in 2050 – TIAM benchmarked to CGE and soft-linked model



Suggestions for your reading list...

Quantifying uncertainty in China's regional energy future towards 2050: a global model soft-linking and comparison exercise

Applied Energy, peer-reviewed invited study, forthcoming

Modelling tools for China's future energy system - a review of the Chinese perspective

2014, ENERGY, peer-reviewed invited study, 560+ downloads

Going West: Investments in mega-energy projects in China during the 12th Five-Year Plan

Energy, peer-reviewed study, forthcoming

Mapping and benchmarking regional disparities in China's energy supply, transformation and end-use in 2010

Applied Energy, peer reviewed study, forthcoming

Impacts of a renewable energy quota system on China's future power sector

Energy Procedia, peer-reviewed conference proceedings, forthcoming

